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ABSTRACT

Graphomotor output was assessed in children with attentional problems using the Repeated Patterns Test (RPT). Forty-eight subjects, ages 8 to 13, who met standard criteria for Attention Deficit Hyperactivity Disorder (ADHD), participated, of whom 24 had primarily Inattentive Type and 24 had Combined Type ADHD. Both groups had intact visuomotor integration and visual perception abilities. Results revealed that, compared to age-matched normally developing children, both groups demonstrated impairments on this test. The additional feature of hyperactivity further impaired performance. It was concluded that the differences between groups on the RPT reflect underlying inattention, impulsivity, and/or executive dysfunction typically associated with Attention Deficit Disorder. The RPT was judged to be a sensitive tool for the evaluation of graphomotor output in children with attention problems and possibly a valuable instrument to include in assessments. (Author/DB)

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QUALITATIVE ANALYSIS OF GRAPHOMOTOR OUTPUT IN CHILDREN WITH ATTENTIONAL DISORDERS.

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Graphomotor output was assessed in children with attentional problems using the Repeated Patterns Test. Forty-eight subjects between the ages of 8 - 13, meeting DSM-IV criteria for Attention Deficit Hyperactivity Disorder participated. Twenty-four subjects had primarily Inattentive Type and 24 had Combined Type. Both groups had intact visuomotor integration and visual perception abilities. Results revealed that compared to normal children, both groups demonstrated impairments on this test. The additional feature of hyperactivity further impaired performance. The RPT is a sensitive tool for the evaluation of graphomotor output in children with attentional problems, and may be a valuable instrument to include in assessments.

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Introduction

The constellation of behaviors typically associated with Attention Deficit Hyperactivity Disorder (ADHD) include inattention, impulsivity and hyperactivity. These behaviors are manifested across a range of cognitive and behavioral domains. In a number of neuropsychological studies, children with ADHD have been shown to demonstrate a difficulties in fine motor control which has been reflected in poor performance on tasks sensitive to fine motor dexterity as well as in poor handwriting. The Repeated Patterns Test (RPT) has been shown to be an efficient and reliable way to assess graphomotor-output in children (Waber and Bernstein, 1994). In their study, Waber and Bernstein demonstrated that children referred to a learning disabilities clinic could be reliably distinguished from an age and gender matched normal control group on this easy to administer test. Specifically, children with LDs were shown to have difficulty, relative to normal peers, in the generation of a continuous pattern. Waber and Bernstein speculate that the RPT may be sensitive to both attentional and motor functions, in that this test allows one to observe a child's ability to sustain a repetitive motor activity, as well as to successfully inhibit one motor movement in order to begin another.

To this end, we examined the RPT performance of children between the ages of 8 and 13 who had been diagnosed with Attention Deficit Disorder (Combined Type; ADHD) or Attention Deficit Disorder (Inattentive Type; ADD). We hypothesized that both groups would have difficulty on this task relative to a normal controls. We further hypothesize that the addition of hyperactivity would serve to adversely impact performance on this test.

Method

Subjects. Subjects were identified retrospectively from clinic files and were included in the study if they met DSM-IV (APA, 1994) criteria for ADHD and the inclusionary criteria described below. All clinical subjects were seen for evaluation in a Neurodevelopmental Clinic at a metropolitan university-affiliated medical center.

All subjects had obtained a Full Scale IQ (on either the WISC-R, WISC-III or Stanford Binet) of greater than 80. If no IQ score was available, a child was included only if he or she had never been referred for special education testing. All subjects spoke English as their primary language. No subject was on medication for the treatment of ADHD at the time of their evaluation. Selection for inclusion in this study was made without knowledge of subjects' performance on any of the neuropsychological tests.

A total of 48 subjects, between the ages of 8 and 13 were included in the study. Twenty four subjects (16 male and 8 female, mean age in years = 10.8) were diagnosed as having ADD. Twenty four subjects (20 male and 4 female, mean age in years = 9.8) were diagnosed as having ADHD. The difference in age between the two groups did not reach statistical significance. The gender distribution of the subjects in this study is generally consistent with those reported for children with ADHD, i.e. three to four times as many males as females (APA, 1994). Demographics are summarized in Table 1.

Table 1: Subject Demographics

	ADD	ADHD
N	24	24
Gender: Male	16	20
Female	8	4
Age: Mean (in years)	10.8	9.8
SD	1.8	1.8
Range	8-13 years	8-13 years

Procedure. To rule out the possibility that deficits in visualspatial perception or visual motor integration might affect subjects performance on the RPT, we examined the subjects' performance on the Hooper Visual Organization Test (HVOT; Hooper, 1958) and the Beery Developmental Test of Visual Motor Integration (VMI; Beery, 1989). The RPT (see Figure 1) was administered as described by Waber and Bernstein (1994). All tests were administered as part of a larger battery of neuropsychological tests.

Figure 1: Repeated Patterns Test

Data Reduction. The HVOT and VMI were scored in the standard manner. Normative data published by Kirk (1992) was used for the HVOT and normative data published by Beery (1989) was used for the VMI. For the RPT data, the quality of each of the five patterns was scored on the basis of a 5-point rating scales using templates provided by Waber and Bernstein (1994). Each of the five patterns was scored by three independent raters, for a total of 240 ratings. Raters were blind to subject diagnosis, age and gender. On 85% of the ratings, the three raters were in exact agreement (34%) or two of the three raters were in exact agreement with the

third score deviating by one point (51%). For each pattern, an average score was calculated based on upon the three independent ratings. The scores for each of the five patterns were summed to generate a single global quality score for each subject. Z-scores were calculated using the appropriate age and gender norms published by Waber and Bernstein (1994).

Results

Data for the three tests are presented in Table 2. In both groups of subjects, there was no evidence of impairment in visual perception or visual construction as demonstrated by performances falling within the average range on the HVOT and VMI. Thus performance on the RPT was not influenced by underlying deficits in visual perception or visuomotor integration.

Table 2: Neuropsychological Data

	ADD	ADHD
Mean VMI (standard score)	97.3	92.8
SD	10.8	8.2
Mean HVOT (z score)	.27	-.02
SD	1.24	.85
RPT (z score)	-1.08	-2.43
SD	.63	1.7

On the RPT, both subjects with ADHD and ADD earned significantly lower quality scores as compared to normative data, with z scores falling grater than one mean below the normative population. A statistically significant difference was found between the quality of subjects with ADHD and ADD, with subjects with ADHD earning significantly lower scores, $F(1,46) = 9.32$, $p<.01$).

Discussion

In summary, this quick, easy to administer to test served to reliably distinguish a group of children with ADD and ADHD from age-matched controls. The lower performance of the two groups does not appear to be accounted for by frank deficits in visual-motor integration or visual perception. Rather the differences between the two groups on the RPT reflects underlying inattention, impulsivity and or executive dysfunction that is typically associated with Attention Deficit Disorder. Furthermore, the results of this study suggests that the additional component of hyperactivity incrementally impairs performance on the RPT. Ultimately, the RPT may be a useful device to add to a comprehensive neuropsychological battery for screening of attentional disorders and may be a time efficient and economic tool for the determination of medication effects in this population.

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